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(54) **Spherical granules having core and their production.**

(57) The spherical granules having a core coated with spraying powder containing a drug and low substituted hydroxypropylcellulose, because of their excellent hardness, can be coated further evenly, (e.g. sustained release coating, gastric coating, enteric coating), and at the time the granules are excellent disintegration.

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Spherical Granules Having Core and Their Production

This invention relates to spherical granules having a core excellent in hardness and disintegration, and to their production.

Recently many studies have been made on drug delivery systems; especially as the dosage form for oral administration, granules coated with various coating agents, i.e. so-called coating granules have been used increasingly frequently, and the granules as they are or capsules produced by filling the granules in capsules have been developed.

As reasons for this fact may be mentioned that granules, as compared with tablets biopharmaceutically, reduce individual variations in gastric emptying rate, absorption, etc. and little affected by food (intake).

For production of spherical granules, the method wherein after granulation by extrusion the granules are made spherical with a marumerizer is most commonly used, but the granules thus produced are mostly not perfect spheres and the granule size distribution is wide; therefore it is said that uniform coating is so difficult that pharmaceutical preparations for precisely controlled release are difficult to be obtained.

On the other hand, recently a centrifugal fluidized-bed coating-granulator (sometimes abbreviated as CF granulator hereinafter) has been developed, and a method to make the granules spherical with this granulator has been tried.

In this method the surface of a spherical seed core or core is coated, while being sprayed with water or a solution containing a binder, with a spraying powder containing a drug, and thus spherical granules of high perfect sphere content and narrow granule size distribution are obtained. [See Drug Development and Industrial Pharmacy, 11(8), 1523-1541 (1985).]

To produce pharmaceutical preparations for controlled release the surface of the resulting spherical granules is coated with wax or polymer for the purpose of control of release of the drug. The coating is performed generally by fluidized-bed coating.

In the initial phase of the process of the fluidized-bed coating, there occur frequently troubles such as breaking and scraping of the spherical granules. These troubles not only damage the drug release control function but also affect greatly the yield in production of granules; thus a method for production of spherical granules excellent in hardness and disintegration has been desired.

Under these circumstances, the inventors investigated the method for production of spherical granules excellent in hardness and disintegration by using the CF granulator, and have completed this invention.

This invention relates to

(1) spherical granules having a core coated with spraying powder containing a drug and low substituted hydroxypropylcellulose, and to

(2) a method for producing spherical granules having a core characterized in that seed cores are coated, while being sprayed with an aqueous binder, with spraying powder containing a drug and low substituted hydroxypropylcellulose.

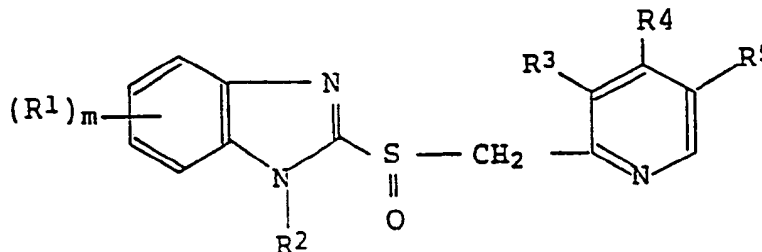
The content of the hydroxypropoxyl group in the low substituted hydroxypropylcellulose (sometimes abbreviated as L-HPC hereinafter) used in this invention is generally about 4 - 20 %, preferably 5.0 - 16.0 %, more preferably 10.0 - 13.0 %. The mean particle size of the L-HPC may generally be not more than 200 μm in diameter, preferably not more than 100 μm , more preferably not more than 30 μm .

The drugs are not particularly defined as far as they can be used in the form of granules, including drugs for the central nervous system such as diazepam, idebenone, aspirin, ibuprofen, paracetamol, naproxen, piroxicam, diclofenac, indometacin, sulindac, lorazepam, nitrazepam, phenytoin, acetoaminophen, ethenzamide, and ketoprofen; drugs for the circulatory system such as molsidomine, vinpocetine, propranolol, methyldopa, dipyridamole, furosemide, triamteren, nifedipine, atenolol, spironolactone, metoprolol, pindolol, captopril, and isosorbide nitrate; drugs for the respiratory system such as amlexanox, dextromethorphan, theophylline, pseudoephedrine, salbutamol, and guaifenesin; drugs for the digestive system such as benzimidazoles described below, cimetidine, ranitidine, pancreatin, and 5-aminosalicylic acid; antibiotics and chemotherapeutic agents such as cephalixin, cefaclor, cefradine, amoxicillin, pivampicillin, bacampicillin, dicloxacillin, erythromycin, erythromycin stearate, lincomycin, doxycycline, trimethoprim, and sulfamethoxazole; drugs for metabolic system such as serrapeptase, glibenclamide, and potassium chloride; and vitamin drugs such as vitamin B₁, vitamin B₂, vitamin B₆, vitamin C, and fursultiamine.

The said benzimidazoles include those described in US Patent No. 4045563, US Patent No. 4255431, European Patent Publication No. 4472409, European Patent Publication No. 5129, European Patent Publication No. 45200 US Patent No. 4472409, European Patent Publication No. 5129, British Patent Publication No. 2134523, European Patent Publication No. 174726, European Patent Publica-

tion No. 175464. and European Patent Publication No. 208452 etc.

The benzimidazoles having antiulcer activity, which are described in the above laid-open patent specifications, for instance are represented by the formula



wherein R^1 is hydrogen, alkyl, halogen, cyano, carboxy, carboalkoxy, carboalkoxyalkyl, carbamoyl, carbamoylalkyl, hydroxy, alkoxy, hydroxyalkyl, trifluoromethyl, acyl, carbamoyloxy, nitro, acyloxy, aryl, aryloxy, alkylthio or alkylsulfinyl, R^2 is hydrogen, alkyl, acyl, carboalkoxy, carbamoyl, alkylcarbamoyl, dialkylcarbamoyl, alkylcarbonylmethyl, alkoxy carbonylmethyl or alkylsulfonyl, R^3 and R^5 are the same or different and each is hydrogen, alkyl, alkoxy or alkoxyalkoxy wherein R^4 is hydrogen, alkyl, alkoxy which may optionally be fluorinated, or alkoxyalkoxy, and m is an integer of 0 through 4.

The compounds of the formula (I) can be produced by the methods described in the above-cited laid-open patent specifications or modifications thereof.

In the following, brief mention is made of the substituents in those compounds which have the formula (I) and are already known.

Referring to R^1 in the above formula, C_{1-7} alkyls may be mentioned as the alkyl represented by R^1 ; C_{1-4} alkoxy as the alkoxy moiety of the carboalkoxy; C_{1-4} alkoxy as the alkoxy moiety of the carboalkoxyalkyl and C_{1-4} alkyls as the alkyl moiety; C_{1-4} alkyls as the alkyl moiety of the carbamoylalkyl; C_{1-5} alkoxy as the alkoxy; C_{1-7} alkyls as the alkyl moiety of the hydroxyalkyl; C_{1-4} alkanoyls as the acyl; phenyl as the aryl; phenyl as the aryl moiety of the aryloxy; C_{1-6} alkyls as the alkyl moiety of the alkylthio; and C_{1-6} alkyls as the alkyl moiety of the alkylsulfinyl.

Referring to R^2 , C_{1-5} alkyls may be mentioned as the alkyl represented by R^2 ; C_{1-4} alkanoyls as the acyl; C_{1-4} alkoxy as the alkoxy moiety of the carboalkoxy; C_{1-4} alkyls as the alkyl moiety of the alkylcarbamoyl; C_{1-4} alkyls as each of the alkyl moieties of the dialkylcarbamoyl; C_{1-4} alkyls as the alkyl moiety of the alkylcarbonylmethyl; C_{1-4} alkoxy as the alkoxy moiety of the alkoxy carbonylmethyl; and C_{1-4} alkyls as the alkyl moiety of the alkylsulfonyl.

Referring to R^3 , R^4 and R^5 , C_{1-4} alkyls may be mentioned as the alkyl represented by any of them; C_{1-4} alkoxy as the alkoxy; and C_{1-4} alkoxy as each of the alkoxy moieties of the alkoxyalkoxy.

Referring to R^4 , C_{1-8} alkoxy may be mentioned as the alkoxy, which may optionally be fluorinated.

More specifically, they include 2-[[3-methyl-4-(2,2,2-trifluoroethoxy)-2-pyridyl]methylsulfinyl]benzimidazole, and 5-methoxy-2-[(4-methoxy-3,5-dimethyl-2-pyridyl)methylsulfinyl]benzimidazole etc.

The said seed cores include Nonpareil produced by coating sucrose (75 weight parts) with corn starch (25 weight parts) according to the per se known method, and spherical seed cores using crystalline cellulose. The drug may be used as the seed core. The particle size of the said seed cores is generally 14-80 mesh.

The said aqueous binder includes water, ethanol (concentration: preferably 50% (v/v) or less), and solutions of binders in water or in ethanol; the concentration of the said solutions is generally 0.1 - 80% (w/v), preferably 0.5 - 70% (w/v). The said binders include sucrose, hydroxypropylcellulose, hydroxypropylmethylcellulose, methylcellulose, polyvinylpyrrolidone, pullulan, and gum arabic, which may be used alone or in combination.

The spraying powder containing the drug and L-HPC in this invention may be combined further with powdery additives. The said additives include excipients (e.g. lactose, corn starch, sucrose, crystalline cellulose, light anhydrous silicic acid), binders (e.g. α -starch, methylcellulose, carboxymethylcellulose, hydroxypropylcellulose, hydroxypropylmethylcellulose, polyvinylpyrrolidone, pullulan, dextrin, gum arabic), disintegrators (e.g. calcium carboxymethylcellulose, starch), stabilizers (e.g. magnesium carbonate, calcium carbonate, L-cystein), and coloring agents (e.g. talc, iron sesquioxide, tar colors).

The said spraying powder in this invention are obtained by mixing uniformly the drug, L-HPC, and the additives described above, and the particle size is generally not more than about 100 μ m, preferably not

The combination ratio of L-HPC to the spraying powder is preferably about 5 - 90% (w/w), more preferably about 10 - 60% (w/w).

The combination ratio of the drug to the spraying powder depends upon the kind and the dose of the drug, being about 2 - 70% (w/w), preferably about 5 - 50% (w/w).

5 In the following the method for production of spherical granules having a core of this invention is described in detail. The conditions under which seed cores are coated with spraying powder while being sprayed with an aqueous binder are the ratio of the aqueous binder to the spraying powder of about 1:1 - 1:2 is adequate; the production temperature need not be controlled being generally room temperature (1 - 30°C). Spherical granules having a core of even size are obtained by sieving after drying. For example, 12 - 32 mesh round sieves are used, and the granules which pass through the 12 mesh sieve but do not pass 10 through the 32 mesh sieve are selected.

The spherical granules having a core thus obtained may be coated according to the per se known method for the purpose of taste masking, enteric coating, gastric coating, or prolongation, and/or filled in capsules according to the per se known method.

15 The said coating agents include hydroxypropylmethylcellulose, ethylcellulose, hydroxymethylcellulose, hydroxypropylcellulose, polyoxyethyleneglycol, Tween 80, pluronic F 68, castor oil, cellulose acetate phthalate, hydroxypropylmethylcellulose phthalate, hydroxymethylcellulose acetate succinate, Eudragit (Röhm Pharma Co., West Germany, acrylate copolymer), carboxymethylethylcellulose, polyvinylacetal-diethylaminoacetate, waxes, and pigments such as talc, titanium oxide, ferric oxide.

20 The spherical granules having a core of this invention, because of their excellent hardness, can be further coated evenly (e.g. sustained release coating, gastric coating, enteric coating), and at the same time the granules are excellent in disintegration.

In the following, this invention is illustrated in detail with working examples and experimental examples, which however should not limit this invention.

25

Example 1

Nonpareils (20 - 28 mesh), 2250 g, were brought into the CF granulator (CF-360, Freund Industrial Co., 30 Ltd., Japan), and coated, while being sprayed with 2000 ml of hydroxypropylcellulose solution (3% (w/v)) at 25 ml/min, first with the spraying powder 1 and then the spraying powder 2, both of which had been prepared by mixing the ingredients listed below, at the rate of 45 g/min at room temperature with a rotor rotating at 200 rpm, dried under reduced pressure at 40°C for 16 hours, and sieved through round sieves, to give spherical granules having a core of 12 - 32 mesh.

35

[spraying powder 1]

compound A * 450 g
40 magnesium carbonate 450 g
sucrose 450 g
corn starch 45 g
L-HPC 450 g

(degree of substitution with hydroxypropoxyl group: 10.0 - 13.0% (w/w), mean particle size: not more than 45 30 µm. The particles of the same degree of substitution and particle size were used hereinafter.)

50 [spraying powder 2]

sucrose 420 g
corn starch 360 g
L-HPC 360 g

55

Example 2

The granules obtained in Example 1, 3800 g, were brought into the fluidized-bed coator (Okawara Co., Japan), subjected to enteric coating by spraying the enteric coating film solution described below at the rate of 50 ml/min under the controlled conditions of inlet air at 50°C and material temperature at 40°C, to give enteric coated spherical granules having core. The said granules were filled into No.2 hard capsules with a capsule filling machine (Parke-Davis Co., USA), to give capsules.

10 [Enteric coating film solution]

Eudragit L30D-55 628 g
 talc 192 g
 polyethyleneglycol 6000 64 g
 15 titanium oxide 64 g
 Tween 80 32 g
 water 4400 ml

20

[composition of the capsules]

enteric coated granules	240 mg
No.2 hard capsule	65 mg
	<hr/>
	305 mg (per capsule)

30 Example 3

Nonpareils (20 - 28 mesh), 85 g, were brought into a mini CF granulator(Freund Co.), and coated, while being sprayed with water (50 ml) at 2.5 ml/min, with the spraying powder described below at the rate of 5 g/min with a rotor rotating at 400 rpm, dried under reduced pressure at 40°C for 16 hours, and sieved through round sieves, to give spherical granules having a core of 12 - 32 mesh.

[spraying powder]

40 pancreatin 20 g
 sucrose 40 g
 corn starch 20 g
 L-HPC 20 g

45

Example 4

Nonpareils (24 - 32 mesh), 2 kg, were brought into a CF granulator (CF-360, Freund Co.), and coated, while being sprayed with 1% (w/v) hydroxypropylcellulose solution (1000 ml) at 20 ml/min, with the the spraying powder described below at the rate of 40 g/min with a rotor rotating at 200 rpm, dried under reduced pressure at 40°C for 16 hours, and sieved through round sieves, to give spherical granules having a core of 12 - 32 mesh.

55

[spraying powder]

5 serrapeptase 50 g
sucrose 1350 g
corn starch 200 g
L-HPC 400 g

10 Then the granules thus obtained, 300 g, were brought into the fluidized-bed coator (Okawara Co., Japan), subjected to enteric coating by spraying the enteric coating film solution described below at the rate of 50 ml/min under the controlled conditions of inlet air at 50°C and material temperature at 40°C, to give enteric coated spherical granules having a core.

[Enteric coating film solution]

15 hydroxypropylmethylcellulose phthalate 1000 g
castor oil 100 g
talc 20 g
20 acetone 10000 ml

Example 5

25 Nonpareils (24 - 32 mesh), 85 g, were brought into a mini CF granulator (Freund Co.), and coated, while being sprayed with 50% (w/v) solution of sucrose (50 ml) at 5 ml/min, with the spraying powder described below at the rate of 10 g/min with a rotor rotating at 400 rpm, dried under reduced pressure at 40°C for 16 hours, and sieved through round sieves, to give spherical granules having a core of 12 - 32 mesh.

30

[spraying powder]

35 molsidomine 5 g
sucrose 55 g
corn starch 20 g
L-HPC 20 g

40 Example 6

Nonpareils (24 - 32 mesh), 85 g, were brought into a mini CF granulator (Freund Co.), and coated, while being sprayed with 1% (w/v) solution of hydroxypropylmethylcellulose (50 ml) at 2.5 ml/min, with the spraying powder described below at the rate of 5 g/min with a rotor rotating at 400 rpm, dried under reduced pressure at 40°C for 16 hours, and sieved through round sieves, to give spherical granules having a core of 12 - 32 mesh.

[spraying powder]

50 idebenone 20 g
sucrose 20 g
corn starch 25 g
55 L-HPC 35g

Example 6

Spherical seed cores of crystalline cellulose (20 -32 mesh), 85 g, were brought into a mini CF granulator (Freund Co.), and coated, while being sprayed with 1% (w/v) solution of pullulan (50 ml) at 2.5 ml/min, with the the spraying powder described below at the rate of 5 g/min with a rotor rotating at 300 rpm, dried under reduced pressure at 40°C for 16 hours, and sieved through round sieves, to give spherical granules having a core of 12 - 32 mesh.

10 [spraying powder]

amlexanox 25 g
 hydroxypropylmethylcellulose 20 g
 ccm starch 25 g
 15 L-HPC 30g

Example 8

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Crystals of vitamin C (42 - 60 mesh), 80 g, were brought into a mini CF granulator(Freund Co.), and coated, while being sprayed with 2% (w/v) solution of hydroxypropylcellulose (60 ml) at 2.5 ml/min, with the spraying powder described below at the rate of 5 g/min with a rotor rotating at 400 rpm, dried under reduced pressure at 40°C for 16 hours, and sieved through round sieves, to give spherical granules having a core of 12-32 mesh).

25

[spraying powder]

30 cefaclor 50 g
 sucrose 20 g
 corn starch 10 g
 L-HPC 450 g

35

Example 9

Crystals of sucrose (42-60 mesh), 85 g, were brought into a mini CF granulator (Freund Co.), and coated, while being sprayed with water (50 ml) at 2.5 ml/min, with the the spraying powder described below at the rate of 5 g/min with a rotor rotating at 400 rpm, dried under reduced pressure at 40°C for 16 hours, and sieved through round sieves, to give spherical granules having a core of 12 - 32 mesh.

45 [spraying powder]

fursultiamine 5g
 sucrose 35 g
 corn starch 30 g
 50 L-HPC 30 g

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Example 10

Nonpareils (20 - 28 mesh), 1650 g, were brought into the CF granulator (CF-360, Freund Co.), and coated, while being sprayed with 1050 ml of hydroxypropylcellulose solution (2% (w/v)) at 30 ml/min, first with the spraying powder 1 and then the spraying powder 2, both of which had been prepared by mixing the ingredients listed below, at the rate of 60 g/min at room temperature with a rotor rotating at 250 rpm, dried under reduced pressure at 40°C for 16 hours, and sieved through round sieves, to give spherical granules having a core of 14 - 32 mesh.

10

[spraying powder 1]

	compound A *	450 g
	magnesium carbonate	336 g
15	sucrose	279 g
	corn starch	300 g
	L-HPC	354 g

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[spraying powder 2]

	sucrose	300 g
	corn starch	246 g
25	L-HPC	246 g

Example 11

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The granules obtained in Example 10, 3800 g, were brought into the fluidized-bed coator (Okawara Co., Japan), subjected to enteric coating by spraying the enteric coating film solution described below at the rate of 50 ml/min under the controlled conditions of inlet air at 65°C and material temperature at 40°C, to give enteric coated spherical granules having core. To the said granules were added talc and light anhydrous silicic acid, then filled into No. 1 hard capsules with a capsule filling machine (Parke-Davis Co., USA) to give capsules.

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[Enteric coating film solution]

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	Eudragit L30D-55	2018 g (solid; 605 g)
	talc	182 g
	polyethyleneglycol 6000	60 g
	titanium oxide	60g
45	Tween 80	27 g
	water	4230 ml

50

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[composition of the capsules]

5	enteric coated granules	348.8 mg
	compound A	30.0 mg
	magnesium carbonate	22.4 mg
10	Nonpareils	110.0 mg
	sucrose	39.8 mg
	corn starch	36.4 mg
	L-HPC	40.0 mg
15	hydroxypropylcellulose	1.4 mg
	Eudragit L 30D-55	44.6 mg
	talc	13.4 mg
20	polyethyleneglycol 6000	4.4 mg
	titanium oxide	4.4 mg
	Tween 80	2.0 mg
25	talc	0.6 mg
	light anhydrous silicic acid	0.6 mg
	No. 1 hard capsule	79.0 mg
30	429.0 mg (per capsule)	

Experimental Example 1

35 In the method of Example 3, coating was performed with the spraying powder containing the ingredients listed in Table 1 in place of L-HPC to produce spherical granules having core. The said granules thus obtained (12 - 32 mesh), 5 g, were brought into a 50 ml stainless steel cylinder (50 ml, 32 mm in diameter), shaken in a mill (Spex Co., Spexmill) for 30 minutes, and sieved through a 32 mesh round sieve.

40 The residual amount on the sieve was measured to calculate friability for evaluation of hardness of the granules. In addition, disintegration time was also determined according to the method described in the 11th Japanese Pharmacopoeia.

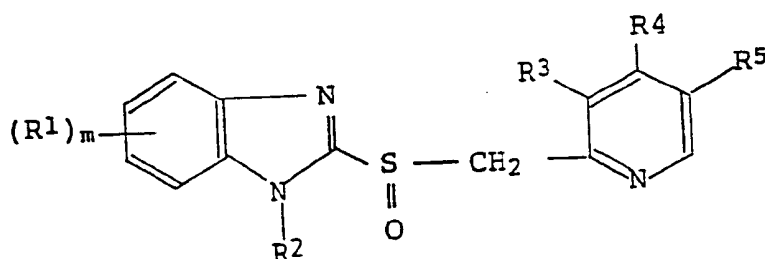
Table 1 Hardness and Disintegration Time of the Granules

		Hardness (%)	Disintegration time
5	This invention	98	1 min
	L-HPC		
	Controls	87	2 min
	crystalline cellulose		
10	α -starch	89	not less than 30 min
	hydroxypropylcellulose	90	10 min
	hydroxypropylmethylcellulose	89	6 min
	polyvinylpyrrolidone	85	4 min
15	pullulan	88	1.5 min
	methylcellulose	84	2 min
	dextrin	85	1 min
20	gum arabic	82	1 min
	carboxymethylcellulose	86	2 min

25 These results show evidently that the spherical granules having a core of this invention are excellent in hardness and disintegration.

Claims

- 30 1. Spherical granules having a core coated with spraying powder containing a drug and low substituted hydroxypropylcellulose.
2. The spherical granules having a core according to claim 1, wherein the drug is a drug for circulatory system, circulatory system, respiratory system, digestive system or metabolic system, antibiotic, chemotherapeutic agent or vitamin.
- 35 3. The spherical granules having a core according to claim 1, wherein the drug is diazepam, idebenone, aspirin, ibuprofen, paracetamol, naproxen, piroxicam, diclofenac, indometacin, sulindac, lorazepam, nitrazepam, phenytoin, acetoaminophen, ethenzamide, ketoprofen, molsidomine, vinpocetine, propranolol, methyldopa, dipyridamole, furosemide, triamteren, nifedipine, atenolol, spironolactone, metoprolol, pindolol, captopril or isosorbide nitrate, amlexanox, dextromethorphan, theophylline, pseudoephedrine, salbutamol, guafenesin, benzimidazole compound having antiulcer activity, cimetidine, ranitidine, pancreatin, 5-aminosalicylic acid, cephalixin, cefaclor, cefradine, amoxicillin, pivampicillin, bacampicillin, dicloxacillin, erythromycin, erythromycin stearate, lincomycin, doxycycline, trimethoprim or sulfamethoxazole, serrapeptase, glibenclamide or potassium chloride, vitamin B₁, vitamin B₂, vitamin B₆, vitamin C or fursultiamine.
- 40 4. The spherical granules having a core according to claim 3, wherein the benzimidazole compound is represented by the formula
- 45



bamoylalkyl, hydroxy, alkoxy, hydroxyalkyl, trifluoromethyl, acyl, carbamoyloxy, nitro, acyloxy, aryl, aryloxy, alkylthio or alkylsulfinyl, R² is hydrogen, alkyl, acyl, carboalkoxy, carbamoyl, alkylcarbamoyl, dialkylcarbamoyl, alkylcarbonylmethyl, alkoxycarbonylmethyl or alkylsulfonyl, R³ and R⁵ are the same or different and each is hydrogen, alkyl, alkoxy or alkoxyalkoxy, R⁴ is hydrogen, alkyl, alkoxy which may optionally be fluorinated, or alkoxyalkoxy, and m is an integer of 0 through 4.

5 The spherical granules having a core according to claim 1, wherein the low substituted hydroxypropylcellulose has 4 to 20 % of the content of the hydroxypropoxyl group and is not more than 200 μ m in diameter in mean particle size.

6. A method for producing spherical granules having a core characterized in that seed cores are coated, while being sprayed with an aqueous binder, with spraying powder containing a drug and low substituted hydroxypropylcellulose.

7. The method according to claim 6, wherein the seed cores are Nonpareils produced by coating 75 weight parts of sucrose with 25 weight parts of corn starch.

8. The method according to claim 6, wherein the spraying powder contains 5 to 90 % (w/w) of low substituted hydroxypropylcellulose.

9. The method according to claim 6, wherein the spraying powder contains 2 to 70 % (w/w) of the drug.

10. The method according to claim 6, wherein the ratio of the aqueous binder to the spraying powders is 1:1 to 1:2.

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European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 30 0569

DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	EP-A-0 200 902 (FUJISAWA PHARM.) * Page 27, example 4; page 7, example 3 *	1-3, 5-10
Y	---	4
Y, D	GB-A-2 134 523 (AB HASSLE) * Pages 1-7; page 22, lines 44-46 *	4
A	EP-A-0 159 891 (MORINAGA MILK IND.) * Pages 16, 17, example 1 *	
The present search report has been drawn up for all claims		
Place of search	Date of completion of the search	Examiner
THE HAGUE	21-04-1988	BENZ K. F.
CATEGORY OF CITED DOCUMENTS		
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category L : document cited for other reasons		
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons		

TM 1503 03.82 (10/01)

TECHNICAL FIELDS
SEARCHED (Int. Cl.4)

A 61 K